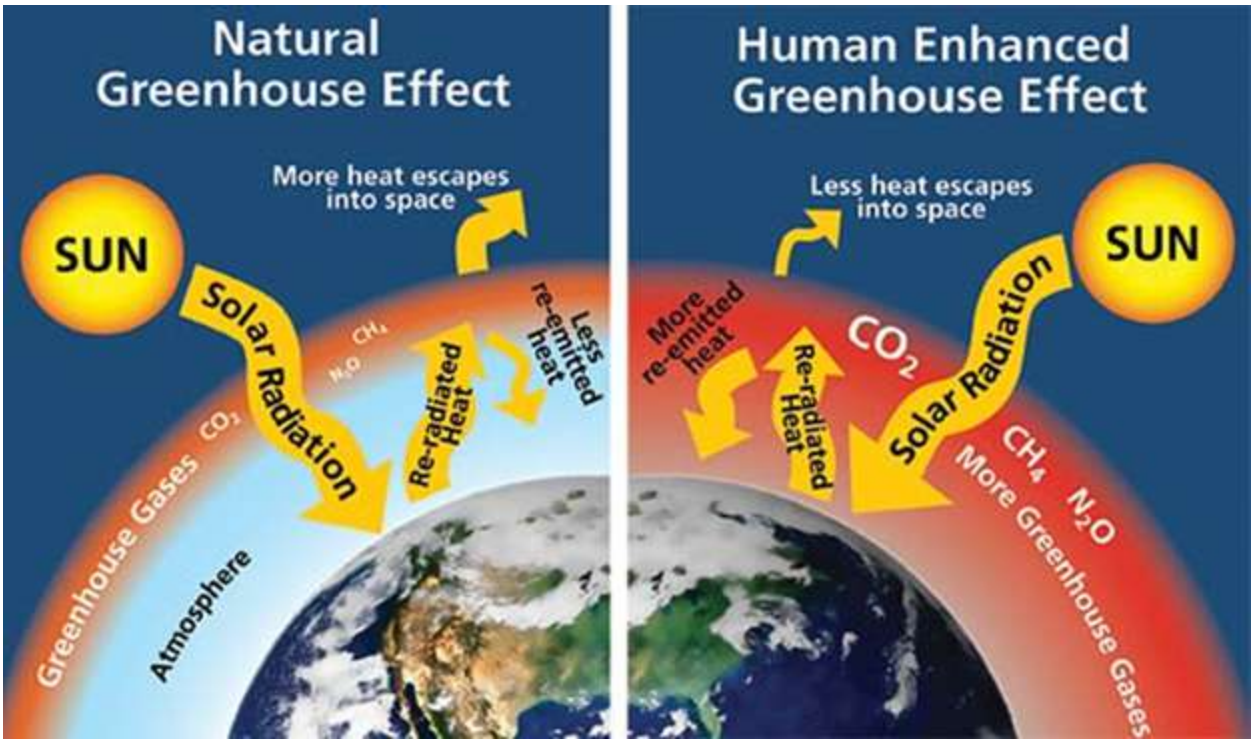
U2D3 Greenhouse Effect and Ozone Layer Readings



Greenhouse Effect

Unfortunately, the label has stuck, but the greenhouse effect in our atmosphere is not exactly like an actual greenhouse. A greenhouse lets in solar energy (mostly in the form of visible light), which keeps it warm and allows the plants inside to grow. The greenhouse stays warm primarily because its glass windows prevent the wind from carrying away the heat. This is very different from the greenhouse effect.

The greenhouse effect occurs on our planet because the atmosphere (the gaseous cloud that surrounds Earth) contains greenhouse gases. Greenhouse gases are special in that they absorb heat. In doing so, they warm the atmosphere around them. Not all gases are greenhouse gases. In fact, nitrogen and oxygen - the most abundant gases in the atmosphere - aren't greenhouse gases. Fortunately for life on Earth, which depends on some atmospheric warming to exist other gases *are*, including water vapor, carbon dioxide, and methane. Without its greenhouse atmosphere, Earth's temperature would plummet to well below freezing.

We know that Earth has been a habitable planet for over 3 billion years. This means that there has always been a greenhouse effect. The carbon dioxide that humanity is adding to the atmosphere today isn't creating the greenhouse effect, it's simply intensifying it.

How the Greenhouse Effect Works

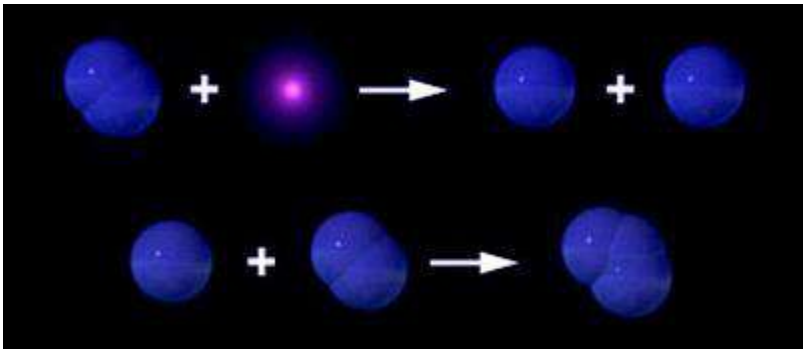
Greenhouse gases allow sunlight to pass through the atmosphere and heat the Earth, but they interfere with the loss of heat from the land and ocean, redirecting some of that heat back to the surface.

1. Earth absorbs solar energy and warms up
2. Like all warm objects Earth begins to radiate (emit) heat.
3. Heat radiating from Earth encounters greenhouse gas molecules in the atmosphere, and is absorbed. The atmosphere warms; as a result, it too radiates heat. Some of this heat is radiated out into space, but the rest is radiated back to Earth's surface This extra energy warms Earth to higher temperatures. When averaged over several years, the energy radiated into space very nearly balances the solar energy absorbed by Earth. Currently, however, Earth is radiating slightly less heat into space than it is receiving from the Sun, because of the recent addition of greenhouse gases to the atmosphere. Consequently, the planet is warming.

How the Ozone Layer Works

BY JANE MCGRATH

How the Ozone Layer Forms and Protects



When UV light hits oxygen gas, it breaks it down to two oxygen atoms. Then, when an oxygen atom meets oxygen gas, it forms ozone gas.

NASA

Most ecosystems rely on the ozone to protect them from harmful **ultraviolet (UV) light**. If you know much about the light spectrum, you'll remember that the varying wavelengths of light determine the color or kind of light. Ultraviolet light falls outside of the range of light that's visible to the human eye, much like microwaves, X-ray and radio waves.

When it comes to UV light, what we don't know (or don't see) can hurt us. UV light from the sun's rays burns our skin and freckles our noses when we're outside on a sunny day. But skin blemishes are the least of our worries. Exposure to UV light can lead to skin cancer and cataracts, and can damage the body's immune system [source: EPA].

Thankfully, the ozone layer protects us from most of the sun's harmful UV rays. Ninety percent of the atmospheric ozone is in the earth's **stratosphere** -- the altitude starting at six to 11 miles (9.6 to 17.7 kilometers) above the earth and extending to about 30 miles (48.3 kilometers) above the earth [source: Fahey]. The stratosphere provides a natural setting conducive to the formation of the ozone, where gas forms a protective layer that completely envelops the earth.

Ozone gas forms in the stratosphere when UV sunlight hits oxygen gas in what is known as the **ozone-oxygen cycle**:

- The first stage of this cycle occurs when short-wavelength UV light from the sun hits a molecule of oxygen gas. The light has so much energy that it breaks the oxygen bond holding the atoms together, thus creating two oxygen atoms. Through this process, the oxygen essentially absorbs the short-wavelength UV light, but this still leaves a significant amount of UV light with longer wavelengths, which is where ozone comes in.
- In the second stage, each of the two remaining oxygen atoms will then latch onto two oxygen gas molecules, creating two separate ozone molecules [source: Fahey].
- Short-wavelength UV light has enough energy to break apart ozone molecules (which are more volatile and easier to separate than oxygen

molecules). Thus, in the third stage of the cycle, the ozone gas then breaks into one oxygen gas molecule and an oxygen atom, hence absorbing much of the remaining UV light.

If you're wondering why these processes "absorb" UV light, it is because they create **exothermic** reactions, meaning they release heat. Essentially, oxygen and ozone convert UV light to heat. Together, ozone and oxygen gas are effective at absorbing about 98 percent of the harmful UV light [source: Sparling].